

Exploring the Effectiveness of Case Teaching Model in Graduate Forest Fire Management Course

Zhongliang Gao*, Wentian Yu, Hechenyang Wang, Zhi Li, Tengteng Long,
Qihua Wang

College of Civil Engineering, Southwest Forestry University, Kunming, Yunnan 650224, China

Abstract

In the context of the new era, forest fire management education must be combined with the characteristics and needs of students at this level to explore new teaching models. Teachers should adhere to the principle of promoting learning through application, starting from the reality, and cultivate and enhance the practical and comprehensive application ability of graduate students in forest fire prevention. The use of case teaching method in the teaching process can effectively cultivate students' thinking abilities in analysis, reasoning, induction, synthesis, and other aspects.

Keywords

Forest Fire Management; Case Study Teaching; Graduate Students.

1. Introduction

Forest fire management is an interdisciplinary field that draws on six major disciplines including forestry, ecology, biology, meteorology, forest engineering, and fire engineering. It is based on the theories of combustion and heat transfer, as well as forestry, with the goal of reducing the harm caused by forest fires. Forest fire management research involves the study of fire prevention and suppression theories and techniques, as well as ecological management of forest fires. The academic master's program in forest fire management is supported by the Key Open Laboratory of Forest Disaster Warning and Control in Yunnan Province, and focuses on research in forest fire ecology and management, with a particular emphasis on the second largest forest region in China, the Southwest Forest Region. The program is based in Yunnan but extends to Southeast Asia. Forest fire management is based on the principles and theories of forest fires and forest combustion, and aims to understand the characteristics and laws of forest fires, as well as the methods and techniques for fire prevention and suppression. This knowledge is then applied in forest fire management practice, such as in the comprehensive management of combustible materials, forest fire prediction and forecasting, planned burning, and fire loss assessment. Therefore, the practical and tool-oriented nature of this discipline is its main focus, with the goal of improving the teaching efficiency of graduate students in forest fire management by starting from the reality and applying theory to practice, and cultivating and enhancing the practical and comprehensive application ability of graduate students in forest fire prevention and management.

2. The Development of Forest Fire Management

Forest fire management education in China began in 1949, following the establishment of the new China. It was disseminated through forestry and forest protection specialties, with a focus on public education and propaganda, but was not independently established in higher education institutions[1]. In the 1960s, forest fire prevention gradually developed into a comprehensive new emerging profession, which integrated interference ecology, landscape

ecology, forest hydrology, and meteorology. Forest fire management became the core course of this profession. The development of forest fire management education took a significant turn following the major forest fire in Daxing'anling, Heilongjiang Province in 1987. Northeast Forestry University, Central South University of Forestry and Technology, and Southwest Forestry University successively established this type of specialty, forming a hierarchical pattern from graduate education to vocational training. However, with the changes in social demand in the 21st century, higher requirements have been placed on forest fire management professionals in terms of theoretical knowledge, professional skills, and creative thinking. In addition, factors such as employment, efficiency, and adjustments to professional settings have also had an impact on forest fire management education. As a result, forest fire management courses and related specialties have been cancelled, causing a significant impact on forest fire management education.

Currently, there are only a few universities that offer graduate-level forest fire management education programs, including Northeast Forestry University, Chinese Academy of Forestry, and Southwest Forestry University. Due to late development, weak theoretical foundations, talent shortages, outdated practical techniques and management methods, among other factors, the integration of educational resources and reform of existing teaching models have become a practical and urgent issue in this field.

3. Problems in the Teaching Process of Forest Fire Management Courses

The course of forest fire management is of great importance to personnel engaged in forest management work. However, the teaching effectiveness of this course in comprehensive forestry universities has always been unsatisfactory. The common problems in forest fire management courses in universities include strong comprehensiveness, lack of practical operation, slow knowledge updates, and unsatisfactory passive learning effectiveness of students[2].

3.1. Outdated Textbooks

Currently, many forest fire management courses in China still use the textbook "Forest Fire Ecology and Management" published by the Chinese Forestry Press in 2005. The references cited in the textbook are mostly before 2000, and the development of forest fire ecology theory and related technologies under global and regional climate change has progressed rapidly. The current textbook contents are outdated, and the proportion of integrating cutting-edge scientific knowledge into the teaching content is relatively small.

3.2. Inefficient Traditional Teaching Methods

The traditional teaching process adopts an imparting teaching method, which, coupled with the time limit, makes the teaching content monotonous and less informative. Students find it difficult to understand the basic concepts of forest fire ecology and related theoretical knowledge involving other forestry disciplines.

3.3. Theory and Practice Mismatch

The traditional teaching process lacks practical teaching, resulting in low student participation and poor understanding of the use of firefighting tools and abstract firefighting tactics. The knowledge system is incomplete, and the learning experience is poor, which affects the training and improvement of innovative talents[3].

4. Advantages of Case-based Teaching Method in Forest Fire Management Education

The case-based teaching method is a teaching method that uses cases as the basis for learning. It allows students to immerse themselves in case scenarios and learn through collective study and discussion, thereby enhancing their ability to analyze and solve practical application problems[4].

4.1. Widely Applicable

The case-based teaching method has been widely used in management and law disciplines[5]. The case-based teaching method originated in the 1920s and was first proposed by the Harvard Business School in the United States. It was then introduced into training and teaching programs in business, medicine, law, accounting, military, and public administration, with a focus on cultivating students' practical application and operational abilities.

4.2. Integration of Theory and Practice

As a practical teaching method, the case-based teaching method's outstanding advantage is to use practical situations to concretize abstract principles and concepts, integrate theory and practice, and stimulate students' learning interest through discussion, thereby training their ability to analyze and solve problems. Fu Weili et al.[6] believe that case-based teaching is one of the most effective teaching methods for guiding students from theory to practice.

4.3. Active Classroom Atmosphere

Constant interaction during the teaching process is the biggest difference between case-based teaching and traditional teaching. The entire classroom should always be in a dynamic process, which can promote communication between teachers and students, among students themselves, and improve the students' activity in the classroom, thereby continuously improving the teaching effectiveness. Not only can effective methods be adopted to improve students' subjective initiative and creativity, but students can also be immersed in the special context of the case, making them the subjects of the classroom and improving their various abilities in the case context.

Based on the characteristics of case-based teaching method mentioned above, its application in forest fire management education can help cultivate students' learning autonomy, enhance their independent thinking ability, teamwork ability, practical language application ability, and innovation ability, thereby effectively improving teaching quality and achieving low-level and high-level teaching objectives in forest fire management education at the graduate level.

4.4. Application of Case Teaching Method in Forest Fire Management Course Practice

Case teaching is not simply giving examples. Qu Peimin [7] pointed out that cases present specific teaching scenes in specific teaching contents, reflect the "cause and effect" of teaching process events, reproduce the plot and details of the interaction between teachers and learners, describe the concreteness and situation of teaching conflicts, and display the behavioral context of solving teaching problems. From this exposition, it can be seen that cases have distinct targeting, coherence, and process, and are key elements integrated into the entire teaching process event. From the initial scene presentation to the final resolution of teaching problems, case teaching has played a corresponding role. In teaching practice, case teaching requires the joint participation of teachers and students, emphasizing that teachers and students discuss specific cases together and draw corresponding conclusions.

For example, in the practical application of case teaching in forest fire management, Student A analyzed major forest fires in foreign countries, especially in forestry-developed countries such

as the United States, Australia, and Canada. Through analyzing the forest fire management methods in these countries, he aimed to inspire improvements in China's forestry management level and reduce the occurrence of major forest fires. Student B analyzed cases of large-scale forest fires in northern China's history, aiming to understand the laws of forest and grassland fires in the northern plains and propose prevention and monitoring methods for this phenomenon. Student C mainly analyzed forest fires in southern China, especially the major forest fires in the southwestern mountainous area, such as the "3.30" major forest fires in Liangshan Prefecture, Sichuan Province. By analyzing cases of forest fires in special terrain, he could make constructive suggestions for forest fire prevention work in the high-altitude forest areas of southwestern China, reduce the occurrence of similar disasters, and avoid tragedies from recurring.

4.5. Issues to Be Aware of When Implementing Case Teaching in Teaching

Although case teaching has many advantages, it also has shortcomings in exploring practice. Its biggest weakness and deficiency is that case teaching cannot replace the teaching and learning of basic theories and knowledge of management [8]. If any teaching method is arbitrarily abused, it will inevitably bring many negative effects. Therefore, when implementing case teaching, the following issues should be noted:

4.5.1. Combining Case Teaching with Theory Lectures

Because case teaching is not omnipotent, it cannot dilute the teaching method of theory lectures. If case teaching is not combined with classroom lectures and other teaching methods, it will be difficult to complete the teaching task. Case teaching must be based on a certain theoretical foundation. Only by thoroughly understanding the basic concepts and principles can case discussions be fully carried out. Therefore, when using case teaching, it should be combined with traditional teaching methods, which will achieve better teaching results.

4.5.2. Continuously Improving the Quality of Teachers Themselves in Case Teaching

The use of case teaching method requires high demands on the teacher's knowledge structure, teaching ability, work attitude, and teaching responsibility. It requires teachers to have extensive theoretical knowledge and practical experience, and to integrate theory with practice. Mastering and applying case teaching methods proficiently is a relatively complex process that requires teachers to practice and explore over a long period of time. It cannot be used proficiently through simple training or observing others' teaching for one or two times. Teachers need to control the situation, organize teaching, play a guiding role, and make students cooperate in teaching activities.

4.5.3. Solving the Problems of Teachers' Difficulty in Obtaining Cases and the Practicality of Cases

At present, the problem faced by case teaching in forest fire prevention in China is how to learn from and study the foreign case teaching model, from directly "borrowed" cases to case localization and domestic production, and ultimately form a complete case teaching system on this basis. Overall, the number of teaching cases in forest fire prevention is seriously inadequate. Only a few textbooks on forest fires and a small number of cases on the Internet cannot meet the demand. Some cases are taken from foreign countries and directly translated, failing to reflect China's reality. The combination of international perspectives and local backgrounds should be considered. More cases are taken from various domestic media, which are not really teaching cases.

4.5.4. Applicability of Case-based teaching

Case-based teaching is suitable for subjects with concrete and practical content, such as medicine, law, and management. For subjects with a stronger theoretical emphasis, the effectiveness of case-based teaching may be limited. Therefore, when using case-based teaching,

it is necessary to choose and adjust according to the characteristics of different subjects and course content, in order to achieve the best teaching effect.

4.5.5. Emphasizing Student Participation and Reflection

Case-based teaching is not simply imparting knowledge, but rather through student participation and cooperation, to generate shared knowledge and understanding. Therefore, in case-based teaching, it is important to emphasize student participation and reflection, encourage students to ask questions, share experiences, and exchange viewpoints, and cultivate students' critical thinking and problem-solving abilities.

4.5.6. Attention to the Evaluation of Case-based Teaching

In case-based teaching, teachers need to evaluate students' performance in order to adjust teaching methods and strategies in a timely manner. Evaluation should not only focus on whether students' answers are correct, but also on their thinking process, analytical ability, and problem-solving ability. Therefore, evaluation should focus on students' thought processes and level of participation, rather than just the results. At the same time, evaluation should pay attention to individual differences and potential for development, and encourage students' innovative and exploratory spirit.

4.5.7. Combining Various Teaching Methods and Resources

Case-based teaching is an effective teaching method, but it is not applicable to all teaching scenarios. Therefore, when designing teaching activities, teachers should combine various teaching methods and resources to meet the learning needs and teaching objectives of different students. For example, various teaching methods such as lectures, discussions, demonstrations, and experiments can be combined, and various teaching resources such as multimedia and online resources can be used to improve teaching quality and effectiveness.

4.5.8. Continuous Improvement and Reflection

Case-based teaching is a continually evolving teaching method, and teachers should continuously reflect and improve their teaching strategies and methods in practice. Teachers can reflect and improve their teaching through observation of students' performance, listening to students' opinions, and collecting feedback information, in order to gradually improve teaching quality and effectiveness. At the same time, teachers should also pay attention to the latest research and teaching methods in their subject area, and continuously update their knowledge and teaching skills.

5. Achievements and Prospects of Curriculum Reform in Forest Fire Management

The preliminary exploration of curriculum reform in forest fire management has achieved good teaching results in recent years, but there is still room for further development and prospects. Firstly, it is necessary to further improve the curriculum system and teaching content, set up corresponding courses for students at different levels and majors, strengthen the practical teaching links, and broaden students' practical abilities and experiences. Secondly, it is necessary to strengthen the construction of the teaching team, improve the teaching level and practical ability of teachers, introduce excellent forest fire management education resources at home and abroad, and enhance the international level of the curriculum. At the same time, it is necessary to fully utilize modern and information technology, carry out diversified teaching modes, such as online courses, virtual laboratories, etc., to improve teaching effectiveness and students' learning experience. Thirdly, it is necessary to strengthen the connection and cooperation with the practical application field, actively carry out practical teaching and scientific research projects, and make greater contributions to forest fire prevention and ecological protection. Fourthly, by transforming the roles between teachers and students,

students become the main learners to acquire knowledge. Based on the mastery of basic knowledge and fundamental theories, various practical activities are used to consolidate the theoretical and practical skills obtained in the classroom. In the specific classroom teaching environment, students can understand the characteristics and rules of forest fires, grasp the methods and techniques of forest fire prevention and suppression, apply them to forest fire prevention practices, carry out comprehensive management of combustibles, forest fire prediction and forecasting, planned burning, fire loss assessment, etc., to improve forest fire management decision-making, support, and firefighting efficiency.

On the basis of fully affirming and utilizing the achievements of information technology resources construction, it is necessary to deeply reflect on and soberly examine the many problems and shortcomings in information technology construction and to recognize the important role of information technology in the internationalization and modernization of higher education[9]. The curriculum reform in forest fire management is based on the dual needs of the country for the training of forest fire personnel and the development of the discipline. With the development of curriculum reform in higher education, it is necessary to continuously explore and innovate in teaching content, teaching mode, and teaching practice, accumulate experience, and gradually improve the curriculum system of forest fire management to train forest fire personnel with high comprehensive quality. In order to achieve better teaching goals, modern and information technology can be used again to serve teaching, multimedia teaching, network teaching, advanced laboratory teaching, which is more conducive to cultivating students' thinking ability and mastering the basic forest fire management knowledge system. This teaching mode contributes to the construction of a strong higher education country[10].

In summary, the curriculum reform in forest fire management is a long-term process that requires continuous exploration and innovation, and constantly adapts to the needs and development of society. Only by continuously improving teaching level and quality, and cultivating more high-quality forest fire personnel, can we better serve the country's forestry ecological construction and society's sustainable development.

Acknowledgments

The authors gratefully acknowledge the financial support from Agriculture and Forestry Working Committee of China Academic Degree and Postgraduate Education Society Fund (2021-NLZX-YB77), Southwest Forestry University Education Fund (YB202104).

References

- [1] Yin J Y, Guo Y J, Li Y, et al. Current situation and development of the construction of forest fire science knowledge system[J]. *Fire Science and Technology*, 2020, 39(4): 550-553.
- [2] Gao C. Discussion on the reform of forest fire management course in comprehensive forestry universities[J]. *Teacher*, 2021(24): 123-124.
- [3] Deng J F, Sun S H, Li H, et al. Research on the information technology teaching reform of forest fire management[J]. *Agricultural Science and Technology and Equipment*, 2020(1): 78-79+82.
- [4] Guo Z X. Research on the optimization of case teaching process[J]. *China University Teaching*, 2010(1): 59-61.
- [5] Yang C J, Zhou J H. A review of case teaching research in China from 1982 to 2020[J]. *Journal of Anshun University*, 2021, 23(5): 72-76.
- [6] Fu W L, Chen D C. Case study of educational management problems[M]. Changchun: Jilin People's Publishing House, 2006.
- [7] Qu P M. On the case teaching of language teaching[M]. Hefei: Anhui Education Press, 2013.

- [8] Wang X Z. Several issues that need to be studied in case teaching[J]. China Higher Education, 2006(12): 44-45.
- [9] Gao Y, Fang Z G, Fan Z G. The evolution of higher education information resources construction model and teaching form[J]. Heilongjiang Higher Education Research, 2015(8): 18-21.
- [10] Li B L, Tian L, Xiao R, et al. Case teaching method support system - development of case library[J]. Chinese Higher Medical Education, 2008(10): 108-109.